

go to prove the truth of evolution are skilfully and attractively marshalled, but that is not the author's chief object. What he aims at is to show that the selection-hypothesis only applies to a limited field, that use-inheritance has its restricted place, and so on; in short, that all our explanations are partial, and that in none of them can we have complete confidence.

When we come to ask on what grounds this want of confidence is asserted, we find the old objections answered fifty years ago by Huxley put forward as if they were discovered yesterday. "Darwinism yields no information concerning the causes of variability" (p. 210); "the theory of natural selection is the doctrine of chance"; "the theory of mutation plays with chance even more than selection." What is Darwinism but a method? The author uses this word as if it implied a corpus of knowledge which could not be extended, and was to be judged by its expression in the writings of casual essayists. In only a single place does he refer either to the "Origin" or to "Variation under Domestication," though he quotes extensively from modern critics. It is idle talk to say that Darwin did this, but not that as though one man could do all, or as if Darwin claimed a complete supremacy for his selection hypothesis. Are we to have no confidence in the theory of natural selection because its discoverer was not able to give a complete treatment of variation? One would really conclude from this book that variation was a subject to which Darwin gave no serious consideration. The old goddess "chance" is once more used as a stick to beat the dog "selection" with, and we become rather tired at the iteration of arguments urged and rebutted any time these thirty years. Even the old crude presentation of the Miltonian "creation" is made to stand up in order to receive fresh blows.

The book is sadly in need of competent revision. The number of misprints is really irritating. Amongst the animals of the tropics we are told there is the leopard and the *gepard*, a creature the nature of which is wholly problematical. The choristers at Rome have well developed "mammals" (p. 148); "*Omni vivum e vivo*" (p. 97); "like all other infusorians, no bell-animalcule is able to reproduce by simple fission" (p. 230); the vermiform appendix "has no function whatever, its object being rather apparently to create suffering." On p. 129 Balanoglossus is classed with Vermes, and the larvæ of Crinoids are termed Bipinnaria, whilst on p. 130 the larvæ of starfish are correctly called by that name, but the figure refers to an Auricularia or Holothurian larva. In his condemnation of sexual selection the author entirely overlooks the careful observations by Mr. and Mrs. Peckham on the spiders of the family Attidæ, and as these support the Darwinian position the whole criticism falls to the ground.

Apart from critical matters, the book is full of interest, and its summary of recent work on heredity is but one example of the wide reading and careful exposition which the author exhibits. Read with due caution the book can only do good.

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AN AMERICAN COLLOQUIUM.

The New Haven Mathematical Colloquium. By E. H. Moore, E. J. Wilczynski, and Max Mason. Pp. x+222. (New Haven: Yale University Press; Oxford: University Press, 1910.) Price 13s. 6d. net.

IN the autumn of 1906, at the meeting of the American Mathematical Society, three short courses of lectures were delivered to the assembled experts, and are here published for the benefit of the world at large, or at any rate for that of such persons as are interested in the most recent aspects of pure mathematics. The authors assume that their hearers have a good knowledge of analysis, and the reviewer must do the same, in order to keep within due limits.

Prof. Moore's discourse is an introduction to general analysis, which may be described as an essay on the "functional theory" of Fréchet and others. A free use is made of the Peano stenography, and this is one more sign of a fact which some of us will admit with regret, namely, that students of the logical side of mathematics must become proficient in Peanese.

Two important ideas play a leading part in Prof. Moore's discussion. The first is the dominance of one function by another; μ_1 is dominated by μ_2 if, for every argument p , the absolute value of $\mu_2(p)$ is not less than the absolute value of $\mu_1(p)$. The other, which appears to be both new and important, is that of uniform convergence relatively to a function σ . Thus we have a notation

$$Lt_n \mu_n = \mu(R; \sigma),$$

meaning that when R is the range of the variable x , and (μ_1, μ_2, \dots) is a sequence of functions of x , this sequence converges in such a way that, by taking n large enough, and for all greater values of n , $|\mu - \mu_n| < e[\sigma(x)]$, where e is any assigned positive number; and if n can be determined by means of e alone (without x), we have uniform convergence relative to σ . When σ is constant, we come back to the usual definition of uniform convergence. The second part of the essay is on composition of classes, which may be described as a generalisation of the theory of the composition of moduli and ideals in the theory of numbers.

In connection with a certain notation, the author remarks that "the intention is to discriminate sharply between function and functional value." With this we confess we are in sympathy, though, of course, we shall be told that a function is merely an enumeration of values, either actually or potentially complete. In the abstract, of course, this is undeniable; but consider the function $\sin x$, for example. Its property of being periodic is intrinsic, and was actually realised before there existed a table of its values, or rather it was made part of a generalised definition of $\sin x$. Again, the class of algebraic numbers, or that of algebraic functions, surely has a significance apart and beyond the aggregate of values associated with it.

The next essay is upon projective differential geometry, especially in connection with ruled surfaces. Various results of great interest and generality are obtained by the author; for instance, it appears that

an arbitrary space curve being given, it can be considered as one branch of the flecnodal curve of an infinity of ruled surfaces, into the general expression of which there enters an arbitrary function. On the other hand, two curves taken at random cannot be connected, point to point, so as to be the complete flecnodal curve on the ruled surface thus generated. As the author remarks, there is no doubt that the field thus opened promises valuable results. So far as the analysis goes, it follows the lines of the known theory of differential invariants, constructed by Halphen, Lie, and others.

Finally, Prof. Mason gives an interesting summary of various boundary-value problems of differential equations. Perhaps one of the most elegant things in this essay is the construction of a doubly periodic Green's function G , which satisfies the equation $\Delta u = 0$ within the period rectangle, except at two points where it is logarithmically discontinuous. This is followed by a remarkable application to the equation $\Delta u = f(x, y)$, where f is periodic in x, y independently, with periods a, b equal to the lengths of the sides of the period rectangle of G .

It is noteworthy to find the United States maintaining so many distinguished mathematicians, both native, and, if we may be excused the term, imported. When will the English nation wake up to the fact that it is not waste of money, or at best a concession to dilettante ideals, to provide a living for a first-rate mathematician, even if he proposes to devote his life to varieties in n dimensions, or the theory of aggregates, or the distribution of primes? Surely, and at an accelerating rate, the dominion over nature and over their fellow-men is coming into the hands of the stargazers, the speculators, the originals, who have been lampooned and pilloried from the age of Aristophanes to that of Swift, and from his days to our own. Or rather, the material profit, the worldly dominion, will come to those nations that have the sense to see that by attracting these creators of new ideas they are encouraging every kind of higher invention, and buying in the cheapest market the best of goods—brains.

G. B. M.

IMPRESSIONIST ASTRONOMY.

The Night-Skies of a Year: Being the Journal of a Star-gazer. By J. H. Elgie. Pp. xii+247. (London and Leeds: Chorley and Pickersgill, Ltd., 1910.) Price 6s. net.

TAKING sections for each month of the year as basis, the varying aspects of the constellations are presented in a series of discursive notes purporting to describe the impressions of the writer on the occasions when he observed the various objects. The author takes as his aim the task of teaching the geography of the sky by means of a journal showing how the constellations alter in their relative aspects from night to night, and at different times on any night. So far this is commendable. It is evident, however, that the desire to produce a volume of impressive magnitude has induced the decision to inflict a superfluity of purely personal impressions; if these were in the main likely to be experienced by

other observers, they might be helpful, but from the nature of many of them it is very questionable if they can be. Take as an example the following:—

"Ten o'clock! Ugh! How drear and dismal is the night, a night unrelieved by star or moon. Rain is beginning to fall. The tempting gleam of a brightly burning fire comes out to me through my window, so I will indoors and try to think that this really is the opening of the 'merrie month.' Then, to round off the evening presently, I will study anew an appropriate article on the old, old question of 'Is the climate changing?' If matters do not mend soon I shall alter my opinion on that subject and persist that the climate is changing."

This quotation is a fair sample of the style of the whole, though here and there one finds an oasis of more acceptable material.

The book is illustrated by numerous rough sketches of constellation groups, and if these were not specially intended for instruction they might be passed over. The author specially directs attention to these sketches, and says:—

"I am convinced from the letters of numerous correspondents that the difficulty of recognising the main outlines of the constellations at any hour from the charts accessible to them has damped the enthusiasm of thousands of beginners in the study of astronomy."

Our opinion is, however, that the star alignment diagrams are perhaps the most unsatisfactory feature of the book. Taking any one constellation, even such a well-known one as Orion, for instance, it is shown with the component stars, in different relative groupings on consecutive pages, due, it must be assumed, to defective drawing. We would advise the "numerous correspondents" to purchase a trustworthy star atlas, and endeavour to commandeer the help of a capable friend for about five minutes each week. This would do away with all the damping of their enthusiasm.

SNAKES OF CEYLON.

The Snakes of Ceylon. By A. F. Abercromby. Pp. vi+89. (London: Murray and Co., 180 Brompton Road, S.W., 1910.) Price 2s. 6d. net.

THE author, being of opinion that the "many works and treatises" in which the snakes of Ceylon are described are "more suited to the scientist than the naturalist," and that "natural history books, on the other hand, seldom give sufficiently detailed information about snakes," has produced a volume which the discerning reader will see at once to be not in the roll of common art. The systematic part being an admitted compilation from well-known works on the fauna of India, we may restrict our inspection to those parts of the book which reveal the originality of the writer.

In dealing with the anatomy and physiology of snakes, the author laments that "the effect of, and antidotes for, snake poison is a subject which has been much written about and much discussed, but very little has been discovered about it." He has heard of permanganate of potash at least, but this, "although a very successful absorbent remedy, is